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**HEAT STROKE EVALUATION
THE FIRST YEARS TRUE FIT iALERT C685**

**PREPARED BY:
MGA RESEARCH CORPORATION
11480 ROBERTSON DR.
MANASSAS, VA 20109**



TEST DATES: August 9, 2013

FINAL REPORT DATE: December 27, 2013

FINAL REPORT

**PREPARED FOR:
ALPHA TECHNOLOGY ASSOCIATE, INC.
2810 OLD LEE HWY, SUITE 120
FAIRFAX, VA 22031**


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Prepared by: 
Patrick Smith, Project Engineer

Date: December 27, 2013

Approved by: 
Steve Fazlovic, Project Engineer

Date: December 27, 2013

Test Technician: Thomas Miller

The results presented in this report relate only to the specified test items. MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

This report replaces C13L4-014M.1 dated December 10, 2013.

Approved by: _____
Alpha Technology Associate, Inc.

Date:

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Overview:

MGA Research Corporation was contracted by Alpha Technology Associates, Inc. under contract #DTNH22-080-D-00088 to conduct a series of evaluations on the First Years True Fit iAlert C685 child restraint system (CRS) (Figure 1). The iAlert C685 is sold as a complete child seat and not just an insert that can be added to an existing child seat. The procedure for evaluation of this product was written by MGA Research. The procedure was based upon a previous project conducted by the Children's Hospital of Philadelphia (CHOP), report number DOT HS 811 632, as well as input from NHTSA.

The iAlert system consists of a control module and pair of weight-detection switches (Figure 2) which monitor the CRS and communicate status to a smartphone. The control module monitors motion, temperature, seat position, and whether a child is seated in the CRS. After initial setup, the system activates upon sensing a child has been placed in the CRS. The control module establishes a communication link with the parent's or caregiver's smartphone and provides notifications in certain circumstances such as if the vehicle has been stopped for a predetermined length of time without the child leaving the CRS.

The seat module used during this evaluation was HW Rev 20130114a Build Date 20130531 and SW Rev 20130601a Build Date 20130601. A Motorola Droid Bionic smartphone running Android version 4.1.2 and the iAlert application from the Google Play Store rev 1.08 was used for each test. During the evaluation, an iPhone 5 running iOS version 6.0.2 and the iAlert application from the Apple Store build 32 was used as a secondary data point for the Alarm Volume Verification test. The iAlert uses Bluetooth technology to communicate with the smartphone application. All tests were conducted at MGA Research Corporation in Manassas, VA. MGA and NHTSA engineers were present for all testing.

The tests were as follows:

- 1) System Activation Assessment
 - a. Representative ATDs and a backpack were used to determine functionality of the system activation
- 2) System Notification Assessment
 - a. The engineer walked away from the CRS with a child installed to determine when the system would produce a notification
- 3) Temperature Assessment
 - a. The CRS was placed in a temperature chamber and slowly heated up to determine when the system would trigger an alarm that the CRS was too hot
- 4) Misuse Assessment
 - a. Saline was poured onto the electronics in the seat to determine if the system would continue to function

Except for the 'notification assessment' tests conducted with no obstructions and the 'while on phone call' tests, all tests were conducted in a laboratory controlled to approximately 72°F. For all testing, the iAlert battery reported 'green' as a charge level.



Figure 1: iAlert C685 installed on simulated seat used for a portion of the assessments

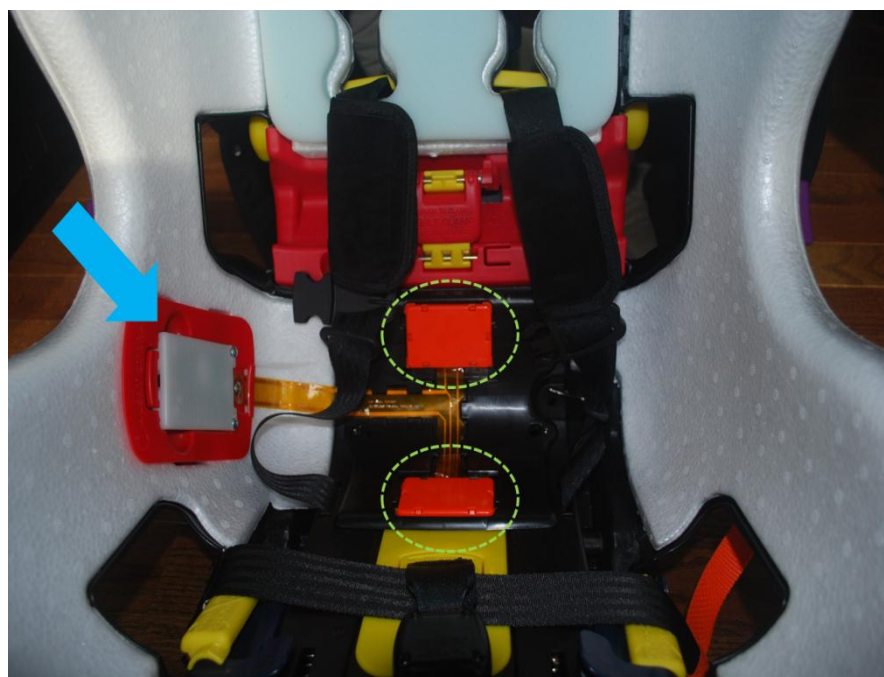


Figure 2: View of True Fit iAlert C685 with cover removed showing control module (indicated by blue arrow) and weight-detection switches (indicated with dashed green ellipses)

Section 1 – System Activation Assessment

Procedure: The iAlert C685 was attached to a representative automotive vehicle seat in both forward and rear facing positions using the lower anchor connectors on the CRS. Applicable Anthropomorphic Test Devices (ATDs) representing a newborn, 12 month old (12mo), 3 year old (3yo), and 6 year old (6yo), were secured in the child restraint system (CRS) in the applicable orientations as exemplified in Figures 1, 3, 4. A weighted backpack (5.5lb) was also used as a misuse scenario (Figure 5). The backpack was alternated between being tossed in the seat and placed in the seat in a prescribed orientation. The tests were conducted inside the temperature controlled lab.

The 6yo ATD was installed with an optional weight kit to provide 62lb of weight. This allowed testing to cover nearly the entire weight range of the seat (5lb-65lb).

The installation was as follows:

Newborn: with infant insert and harness position 1/4

12mo: no infant insert and harness position 2/4

3yo: no infant insert and harness position 3/4

6yo: no infant insert and harness position 4/4

For each trial, the smartphone application was open, with the screen on. If the smartphone application notified that a child was installed in the seat then the trial was marked as OK. If there was no notification then the trial was marked as NO. The smartphone was held in hand approximately 5' from where the CRS was sitting with no obstructions between the smartphone and CRS. Exemplar status screens from the iAlert application are shown in Figure 6.

A total of five trials were performed on each ATD in the applicable orientations. The results can be found in the table (Table 1) below.

Table 1

		Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Overall
Forward Facing	22lb 12mo ATD	OK	OK	OK	OK	OK	OK
	35lb 3yo ATD	OK	OK	OK	OK	OK	OK
	62lb 6yo ATD	OK	OK	OK	OK	OK	OK
	5.5lb backpack	NO	NO	NO	NO	NO	NO
Rear Facing	7lb newborn ATD	OK (1)	OK	OK	OK	OK	OK
	22lb 12mo ATD	OK	OK	OK	OK	OK	OK
	5.5lb backpack	NO	NO	NO	NO	NO	NO

Note (1): The newborn ATD was installed with the additional infant insert padding provided with the CRS. For the initial installation the ATD had to be shifted in the CRS once to trigger the system.



Figure 3: iAlert C685 installed rear facing with 12mo ATD



Figure 4: iAlert C685 installed forward facing with 12mo ATD



Figure 5: iAlert C685 with a 5.5lb backpack used for misuse activation assessment

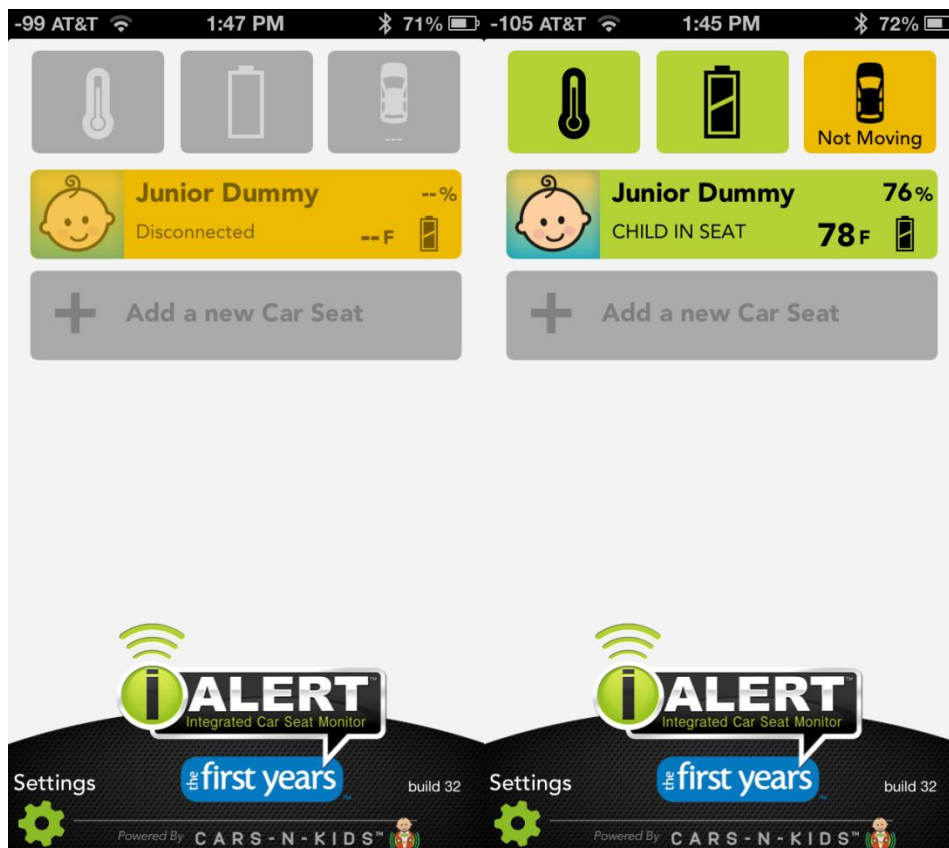


Figure 6: iAlert application screens (shown on iPhone running iOS 6) showing status for unoccupied CRS (left) and occupied CRS in stationary vehicle (right)

Section 2 – System Notification Assessment

The iAlert C685 has a feature that will notify the smartphone if communication is lost with the seat while a child is still present in the seat (Figure 7). Three scenarios were tested and are listed below. Except where noted, all trials involved having the phone screen turned on with the engineer holding the phone in hand with the iAlert application open. A total of five trials were performed for each scenario.

- 1) Scenario One involved no obstructions between the CRS and the smartphone. The CRS was installed rear facing with a 12 month old ATD using the lower anchor connectors in the rear seat of a 2007 Hyundai Sonata (Figure 8). The car was not running during the tests, all doors were closed and windows were rolled up. The engineer confirmed communication between the smartphone and CRS and proceeded to walk away in a straight line, at a constant rate, until a notification appeared on the phone. The distance from the CRS to the location where the application notified the engineer was recorded (Figure 9).
- 2) Scenario Two involved a concrete wall between the CRS and smartphone. The CRS was attached rear facing with a 12mo ATD using the lower anchor connectors on a test bench inside of the test lab. The engineer confirmed communication between the smartphone and CRS and then proceeded to walk away in a straight line, at a constant rate, until reaching an exterior door of the building. The engineer then walked through the door and continued at a constant rate until a notification appeared on the phone. The distance from the CRS to the location where the notification appeared was recorded.
- 3) Scenario Three involved no obstructions between the CRS and the smartphone however the smartphone was engaged in an active call. The CRS was installed rear facing with a 12mo ATD using the lower anchor connectors, in the rear seat of a 2007 Hyundai Sonata. The car was not running, all doors were closed and windows were rolled up. The engineer confirmed communication between the smartphone and CRS and proceeded to walk away in a straight line, at a constant rate, until a notification appeared on the phone. The distance from the CRS to the location where the application notified the engineer was recorded.

Table 2

	Scenario One No Obstructions (ft)	Scenario Two With Concrete Wall (ft)	Scenario Three While on Phone Call (ft)
Trial 1 Distance	253.5	106.0	208.5
Trial 2 Distance	228.5	118.0	210.0
Trial 3 Distance	207.5	117.0	167.5 (1)
Trial 4 Distance	212.0	129.0	219.0
Trial 5 Distance	199.5	43.0 (2)	208.0
Average Distance	220.2	n/a	202.6

Note (1): There was light rain during this trial

Note (2): For this trial the engineer stopped immediately outside the door/wall and waited for several seconds; the phone lost Bluetooth connection and activated the alarm.

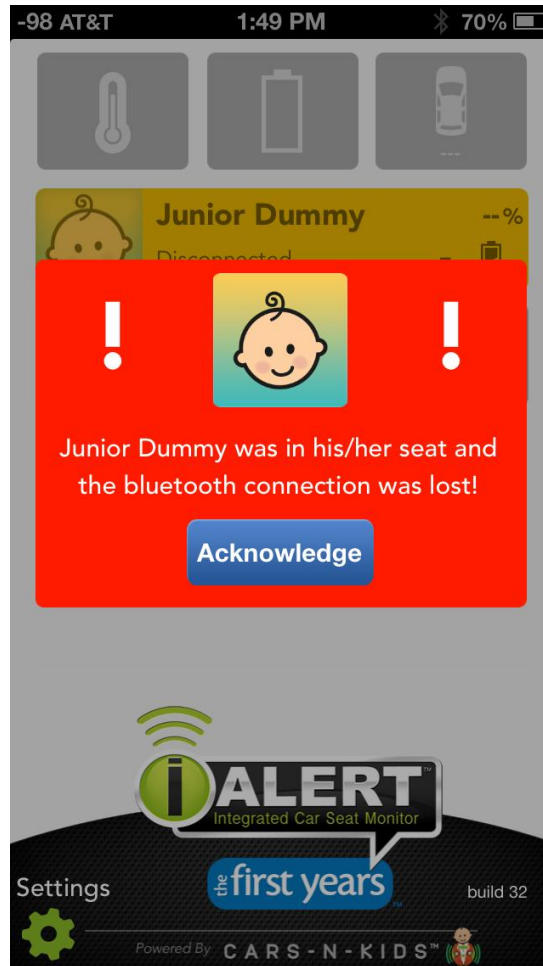


Figure 7: iAlert application screen (shown on iPhone running iOS 6) showing alert when Bluetooth connection is lost with child still in CRS

Observations about the alarm status:

With the iAlert application open and screen and volume on, the alarm consisted of a popup message on screen, audible alarm, and vibration.

One unobstructed trial was conducted with the phone “locked” (screen off) and the volume on. There was a vibration of the phone signaling the Bluetooth disconnection alarm, and no audible alarm.

For Scenario Three, the iAlert was not the on-screen application; instead the phone call was displayed on screen. When the notification activated, the phone vibrated repeatedly and the call screen changed to the iAlert screen with a popup message. There was no audible alarm.

For a trial in Scenario Three, the engineer held the phone to their ear which caused the screen to dim. When the Bluetooth disconnected there was no audible warning, only a short single vibrate. When the phone was removed from ear, a visual notification was on the screen.

Section 2.1 – Alarm Volume Verification

In a quiet room, both the Android smartphone and iPhone smartphone were setup to test the alarm volume. A Larson Davis model 824 SPL meter was used to measure sound pressure levels at approximately the engineer's ear level. The ambient room volume was 26db. With the Android phone in the engineer's jeans' pocket, speaker pointed away from the engineer's body and 'down' the SPL meter read a maximum of 42.4db. With the speaker pointed away from the engineer's body and 'up' it read 41.2db. With the iPhone, pocketed speaker 'up' and away from the engineer's body the SPL meter read 55.7db. With the speaker 'down' and away from the engineer's body it read 53.0db. Each phone was set to maximum volume.



Figure 8: iAlert C685 installed in a 2007 Hyundai Sonata for the unobstructed notification assessment



Figure 9: Outdoor unobstructed area used for notification assessment

Section 3 – Temperature Assessment

In order to assess the temperature warning capabilities of the system the CRS was placed inside of a temperature controllable chamber (Figure 10). A newborn ATD was secured in the seat with additional weight of 9lb to ensure a reliable activation was made with the seat. The temperature chamber's thermocouple was located along an upper edge of the chamber, away from the seat. A temperature sensor was placed on the seat next to the internal iAlert temperature sensor to record the local temperature (Figure 11). The starting temperature of the iAlert C685 was 90°F. The temperature chamber was set to maintain ambient temperature for several minutes before beginning a profile to heat from ambient to 120°F at a rate of 6°F per 5 minute interval. The temperature profile was chosen by NHTSA based on findings from a study published in Pediatrics Vol. 116 No. 1 July 2005. After 40 minutes of incremental heating the chamber was set to maintain 120°F. After an additional 25 minutes the iAlert temperature sensor conveyed no warning to the smartphone. The chamber temperature was then increased to 160°F. The ATD was removed at that time to prevent any damage from occurring. Temperature readings are shown in Figure 12.

When the iAlert reached 101°F the temperature icon on the status screen of the phone application turned red. There was no audible alarm, vibration, or popup alert that notified the user of the temperature increase.



Figure 10: Installation of iAlert C685 in temperature chamber for temperature notification assessment



Figure 11: Temperature recorder installed on seat near iAlert module

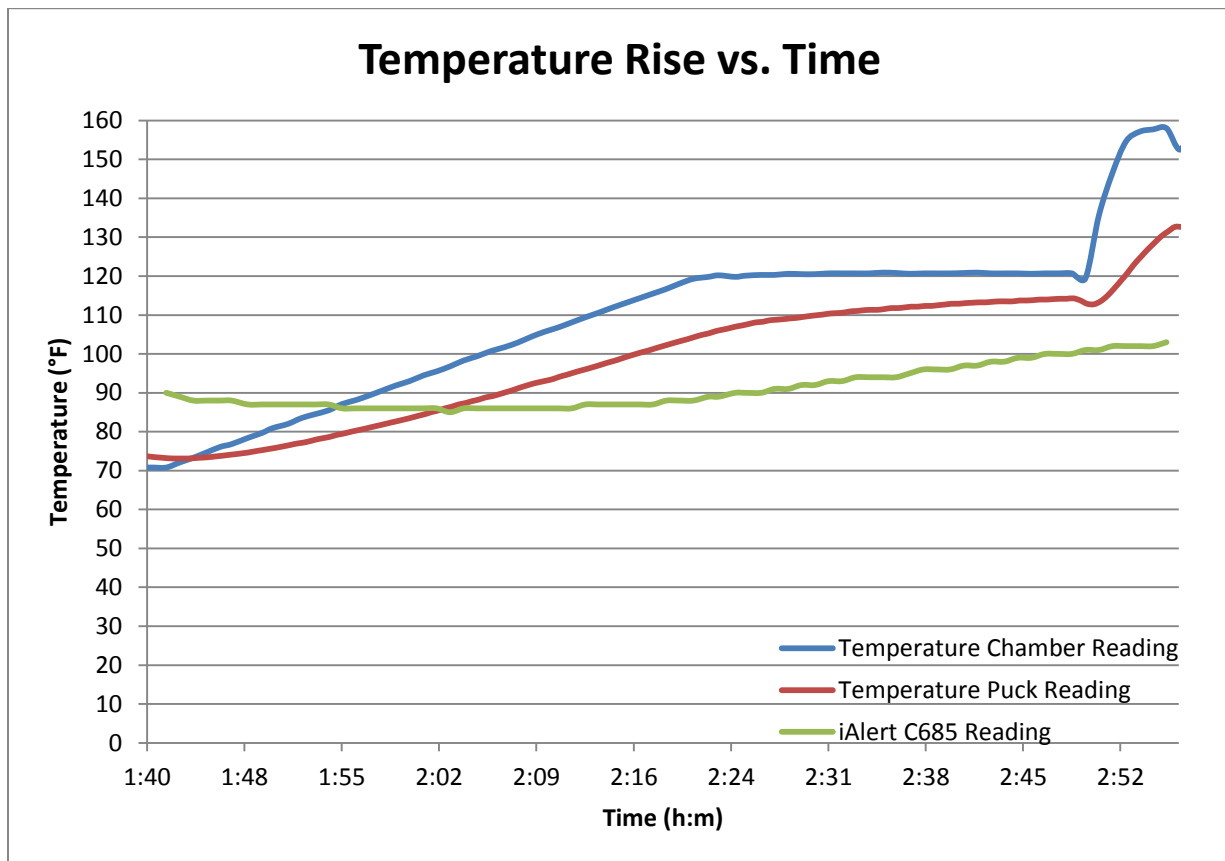


Figure 12: Combined temperature readings from the temperature notification assessment

Section 4 - Misuse Assessment

The final assessment conducted by MGA was a misuse scenario involving liquid contacting the activation switches on the CRS. The CRS was installed rear-facing using the lower anchors to the simulated seat inside of the lab. Four (4) liquid ounces of saline solution (Figure 13) was poured directly on the lower contact switch in the CRS (See Figure 14). A 12mo ATD was briefly installed and removed to evaluate functionality of the system immediately after the saline was poured and every 5 minutes thereafter. If a child is seated in the CRS, the smartphone application will display 'connected' as the status. If the child is found to no longer be seated in the CRS, the smartphone application will display 'disconnected.'

Table 3

Saline Poured On Bottom Switch		
Time (minutes)	Did the system function?	Notes
0	Yes	None
5	Yes	Battery/Bluetooth housing flashed green with no ATD installed
10	Yes	Smartphone application gave audible confirmation of ATD, displayed the seat angle, and displayed 'disconnected' as status.
15	Yes	Smartphone application gave audible confirmation of ATD, displayed the seat angle, and displayed 'disconnected' as status.
20	No	See Note 1 below
25	N/A	

Note 1: At approximately minute 17 the system triggered and caused the 'connected' status to show without the switch pressed by the ATD. At minute 18 the phone signaled that the child had been in the seat for one minute, typical behavior of the application with a child seated. The test was ended at this point and further evaluation was conducted.

After examining the electrical connections on the system, the engineer noted saline in contact with the exposed electrical traces. Continuity was checked at the battery/Bluetooth connection using a digital multimeter. There was resistance across the normally isolated connection, indicative of a shorted circuit. The electrical system was gently removed from the seat and dried off with a towel in an attempt to clean the system. After cleaning, the system continued to falsely report a child in seat.

The battery/Bluetooth module was checked for functionality outside the system and appeared to function correctly.



Figure 13: Saline used for misuse assessment



Figure 14: Saline application to lower switch housing on CRS

Section 5 – Instrumentation Calibration Data

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Temperature Chamber	25-2344-01RF	Thermotron	8/24/12
Tape Measure	L1706N	Lufkin	For Reference Only
Db Meter	824	Larson Davis	For Reference Only
Data Logger	11012026	Vaisala	5/23/13
Multimeter	159	Fluke	For Reference Only